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(54) **FLUID PUMP FOR A MOTOR VEHICLE**

FLÜSSIGKEITSPUMPE FÜR EIN KRAFTFAHRZEUG

POMPE À FLUIDE POUR UN VÉHICULE MOTORISÉ

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(73) Proprietor: **Pierburg Pump Technology GmbH**

41460 Neuss (DE)

(72) Inventors:

- **OTSUKA, Noriyuki**
41460 Neuss (DE)
- **ROMBACH, Michael**
41470 Neuss (DE)
- **WULF, Andreas**
40549 Düsseldorf (DE)

• **LIMBACH, Marco**

41460 Neuss (DE)

• **MÜNCH, Tobias**

47877 Willich (DE)

• **DIPACE, Antonio**

40227 Düsseldorf (DE)

(74) Representative: **terpatent Patentanwälte ter**
Smitten

Eberlein-Van Hoof Rütten Daubert

Partnerschaftsgesellschaft mbB

Burgunderstraße 29

40549 Düsseldorf (DE)

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Description

[0001] The invention is directed to a fluid pump for a motor vehicle, preferably to an electrically driven motor vehicle purge pump for pumping fuel vapor out of a motor vehicle fuel tank.

[0002] The purge pump is not a displacement pump, but is provided with a fast-rotating pump wheel generating a continuous fluid flow with a relatively high flow rate but with a relatively low pressure. The pump wheel is driven by a driving means being co-rotatably connected with the pump wheel by a rotor shaft. The rotor shaft supporting the pump wheel and the driving means is rotatably supported by a shaft bearing system.

[0003] Generally, the shaft bearing system comprises two axially spaced ball bearings providing a stable support of the rotor shaft and allowing a high-speed rotor shaft rotation. However, the high-speed rotor shaft rotation causes extensive stress within the ball bearings so that an unbalanced load of the bearing system or a tensioning of the bearing system can cause severe damage within the bearing system. This can reduce the pump efficiency of the fluid pump or even can cause damage or failure of the fluid pump. The unbalanced bearing load can be caused, for example, by external vibrations transferred into the bearing system. Since, typically, the bearing receptacle, the rotor shaft and the ball bearings are made of different materials with different thermal expansion coefficients, and since the pump has to withstand ambient temperatures between -40 °C and 150 °C for automotive applications, temperature-induced expansion of the rotor shaft and/or of the bearings relative to the bearing receptacle can also cause an unbalanced bearing load and/or a disadvantageous tensioning of the bearing system. The temperature-induced expansion is further enhanced caused by significant heat generation in the ball bearings during the high-speed rotor shaft rotation.

[0004] US 4,927,326 A discloses a fluid pump with a driving means and with a pump wheel which is co-rotatably connected with the driving means by a rotor shaft. The fluid pump comprises a special shaft bearing system with a floating bearing receptacle, i.e., the bearing receptacle is configured to be moveable with respect to a pump housing. The bearing receptacle is provided with a radially inwardly directed support flange. The shaft bearing system comprises two ball bearings which are fixed to the rotor shaft and press fit into the bearing receptacle. The two ball bearings are arranged at opposite axial sides of the support flange, wherein an outer race of one ball bearing is axially preloaded away from the support flange by a preload spring. The floating bearing receptacle avoids or at least minimizes transfer of external vibrations into the bearing system. However, the floating bearing receptacle requires a very complex attachment of the bearing receptacle to the pump housing.

[0005] It is an object of the invention to provide a fluid pump for a motor vehicle, which provides a high pump

performance over a long pump lifetime.

[0006] This object is achieved with a fluid pump for a motor vehicle with the features of claim 1.

[0007] The fluid pump according to the invention is provided with a driving means and with a pump wheel being co-rotatably connected with the driving means by a rotor shaft. The driving means and the pump wheel are both co-rotatably attached to the rotor shaft so that the pump wheel is driven by the driving means. Typically, the driving means and the pump wheel are located at opposite axial ends of the rotor shaft. The driving means can be, for example, a turbine wheel, a pulley wheel or a gear wheel if the pump is mechanically driven, or alternatively can be a motor rotor of an electric motor if the pump is electrically driven.

[0008] The fluid pump according to the invention is also provided with a shaft bearing system for the rotor shaft, which comprises a static bearing receptacle and two floating ball bearings. The bearing receptacle can be, for example, provided integrally with a static pump housing or can be provided as a separate arrangement statically arranged within the pump housing. The bearing receptacle radially surrounds the rotor shaft and is, typically, provided with a cylindrical inside contour. The bearing receptacle is provided with a relatively long axial length relative to the axial length of the rotor shaft, preferably the axial length of the bearing receptacle is at least half the axial length of the rotor shaft, to provide a reliable support of the rotor shaft and, in particular, to avoid tilting of the rotor shaft. The bearing receptacle is provided with a radially inwardly directed axial support flange protruding from the radial inside of the bearing receptacle. The support flange is located axially spaced with respect to both axial ends of the bearing receptacle. Preferably, the radial height of the support flange is substantially equal to the radial height of outer races of the ball bearings.

[0009] The two ball bearings are both fixed to the radial outside of the rotor shaft, i.e. an inner race of each ball bearing is directly fixed to the rotor shaft. Both ball bearings are provided axially shiftable within the bearing receptacle. A first ball bearing is positioned at a first axial side of the support flange and a second ball bearing is positioned at the opposite axial side of the support flange. Preferably, the ball bearings are located at or close to opposite axial ends of the bearing receptacle to provide a stable rotor shaft support. The outer race of the second ball bearing is axially preloaded away from the support flange by a preload spring so that the outer race of the first ball bearing is pushed into touching axial contact with the opposite axial side of the support flange. As a result, both ball bearings are reliably axially supported within the bearing receptacle and are well-defined axially preloaded.

[0010] Since both ball bearings are provided axially shiftable in the bearing receptacle, the ball bearings and, as a result, the rotor shaft can axially move with respect to the bearing receptacle and, as a result, with respect to the pump housing. This allows damping axial vibra-

tions within the bearing system so that a transmission of vibrations from the pump housing via the bearing system into the rotor shaft is avoided or at least minimized. The floating ball bearings also allow compensating different temperature-induced axial elongations of the rotor shaft and of the bearing receptacle. As a result, the axial load of the ball bearings is minimized.

[0011] The fluid pump according to the invention is also provided with elastic support rings, wherein each ball bearing is provided with at least one support ring. The support ring is located between the outer race of the ball bearing and the radial inside of the bearing receptacle and radially surrounds the outer race. The support ring is made of an elastic material, preferably made of an elastic plastic. The support ring can be, for example, a conventional and cost-efficient O-ring.

[0012] According to the invention, both ball bearings are radially supported within the bearing receptacle only by the support rings. There is a ring gap between the radial outside of the outer race of the ball bearing and the radial inside of the bearing receptacle so that the ball bearings are not in direct radial contact with the bearing receptacle. The elastic support rings allow vibration damping, in particular a damping of radial vibrations, within the bearing system and, as a result, minimize rotor shaft vibrations. Since there is a gap between the radial outside of the ball bearing and the radial inside of the bearing receptacle, the ball bearing can expand in radial direction without causing tensions or an unbalanced load within the ball bearing.

[0013] The fluid pump according to the invention is provided with a shaft bearing system which minimizes rotor shaft vibrations and which can compensate and tolerate temperature-induced expansions of the rotor shaft and/or of the ball bearings with respect to the bearing receptacle. This minimizes the mechanical load and, as a result, the wear of the bearing system so that the fluid pump according to the inventions can provide a high pump performance over a long pump lifetime.

[0014] In a preferred embodiment of the invention, the outer races of both ball bearings each are provided with at least one positioning ring groove which receives the support ring. The positioning ring grooves reliably support and position the support rings in axial direction. In particular, the positioning grooves avoid that the support rings slip out of the gap between the ball bearing and the bearing receptacle if the bearing is axially moved.

[0015] Alternatively or additionally, the bearing receptacle is provided with positioning ring grooves which receive the support rings. The bearing receptacle is provided with at least two positioning grooves, at least one position groove for each ball bearing. The positioning grooves are positioned so that at least one positioning groove is located within the axial extent of each ball bearing.

[0016] Preferably, each ball bearing is provided with exactly two axially spaced support rings. The two support rings are, preferably, spaced as far away from each other

as possible so that one support ring is located close to a first axial end of the outer race of the ball bearing and the second support ring is located close to the opposite second axial end of the outer race. The two axially spaced support rings provide a stable radial support of the ball bearing within the bearing receptacle and, in particular, avoid tilting of the ball bearing. Nevertheless, the two support rings provide only a relatively small contact area so that the ball bearings can be axially moved within the bearing receptacle without generating significant friction and, as a result, without generating significant axial bearing load.

[0017] In a preferred embodiment of the invention, the shaft bearing system is arranged axially between the driving means and the pump wheel. As a result, the center of mass of the complete rotor arrangement, which includes the rotor shaft, the pump wheel and the driving means, is located within the bearing system so that the bearing system has to withstand only relatively low leverage forces.

[0018] Preferably, the driving means is a motor rotor of an electric motor so that the fluid pump is electrically driven by the electric motor. The electric motor, and as a result, the fluid pump can be controlled very exactly. The electric motor also allows controlling the fluid pump independent of a motor vehicle engine without complex mechanical arrangements.

[0019] In a preferred embodiment of the invention, the fluid pump is a gas pump and, in particular, a purge pump for pumping fuel vapor out of a motor vehicle fuel tank.

[0020] Generally, it is favorable to fix the ball bearings to the rotor to provide an easy assembly of the fluid pump. However, in some circumstances, providing the fluid pump with an inverse kinematic concept can be preferable. Here, the ball bearings are both fixed to the radial inside of the bearing receptacle and are provided axially shiftable with respect to the rotor shaft and so that the axial support flange is provided at the radial outside of the rotor shaft. Both ball bearings are each fixed with their outer race to the radial inside of the bearing receptacle. The inner race of the first ball bearing is in touching axial contact with the axial support flange. The inner race of the second ball bearing is axially preloaded away from the support flange by the preload spring. The elastic support rings are provided at the radial inside of each ball bearing and are located radially between the inner race of the ball bearing and the radial outside of the rotor shaft. This fluid pump also minimizes rotor shaft vibrations and allows compensating and tolerating temperature-induced expansions of the rotor shaft and/or of the ball bearings with respect to the bearing receptacle.

[0021] Different embodiments of the invention are described with reference to the enclosed drawings, wherein

figure 1 shows a longitudinal section of a fluid pump according to the invention,

figure 2 shows an enlarged section of a shaft bearing system of the fluid pump of figure 1, wherein outer

races of ball bearings are provided with positioning grooves,
figure 3 shows an enlarged section of an alternative shaft bearing system of the fluid pump of figure 1, wherein a bearing receptacle is provided with positioning grooves, and
figure 4 shows an enlarged section of another alternative shaft bearing system of the fluid pump of figure 1, but with an inverse kinematic concept.

[0022] Figure 1 shows a fluid pump 10 which in the present embodiment of the invention is a purge pump for pumping fuel vapor out of a motor vehicle fuel system (not shown).

[0023] The fluid pump is provided with a pump wheel 12 which is co-rotatably attached to a first proximal axial end 14 of a rotor shaft 16 and with a driving means 18 which is directly fixed to a second distal axial end 20 of the rotor shaft 16. The rotor shaft 16 extends substantially in an axial pump direction. In the present embodiment of the invention, the driving means 18 is a magnetic motor rotor of an electric motor (not shown).

[0024] The rotor shaft 16 and, as a result, the pump wheel 12 and the driving means 18 being attached to the rotor shaft 16 are axially and radially supported within a pump housing 26 by a shaft bearing system 22. The bearing system 22 comprises a static bearing receptacle 24 which, in the present embodiment of the invention is provided integrally with the static pump housing 26. The bearing system 22 also comprises two ball bearings 28,30 arranged radially and axially within the bearing receptacle 24. The bearing receptacle 24 is provided with a radially inwardly directed axial support flange 32. The first ball bearing 28 is located at a first proximal axial side of the support flange 32 and the second ball bearing 30 is located at an opposite second distal axial side of the support flange 32.

[0025] Both ball bearings 28,30 are each provided with an inner race 28a,30a, several bearing balls 28b,30b and an outer race 28c,30c. The inner race 28a,30a of each ball bearing 28,30 is fixed to the radial outside of the rotor shaft 16. The outer race 28c,30c of each ball bearing 28,30 is provided with two axially-spaced positioning ring grooves 28d,30d which each receive an elastic support ring 34. The positioning grooves 28d,30d reliably axially support and position the support rings 34 within the bearing system 22. In the present embodiment of the invention, the elastic support rings 34 are conventional O-rings.

[0026] Both ball bearings 28,30 and, in particular, their outer races 28c,30c are each radially supported within the bearing receptacle 24 only by the support rings 34, i.e. the outer races 28c,30c are not in direct radial contact with the radial inside of the bearing receptacle 24. The outer race 30c of the second ball bearing 30 is axially preloaded away from the support flange 32 by a preload spring 36. The preload spring 36 is in touching contact with the distal axial side of the support flange 32 and

pushes the outer race 30c away from the support flange 32 in the distal axial pump direction. As a result, the outer race 28c of the first ball bearing 28 is axially pushed against the support flange 32 so that the outer race 28c is in touching axial contact with the proximal axial side of the support flange 32. As a result, both ball bearings 28,30 are reliably axially supported and are well-defined axially preloaded so that the rotor shaft 16 and, as a result, the pump wheel 12 and the driving means 14 are reliably supported and positioned within the pump housing 26.

[0027] Nevertheless, both ball bearings 28,30 are axially shiftable with respect to the bearing receptacle 24, because their outer races 28c,30c are not fixed to the bearings receptacle 24. This allows compensating axial vibrations of the pump housing 26 and allows compensating a different temperature-induced axial expansion of the rotor shaft 16 relative to the bearing receptacle 24 without generating significant axial loads within the ball bearings 28,30. Since the ball bearings 28,30 are radially supported only by the elastic support rings 34, the bearing system 22 can also compensate radial vibration of the pump housing and can compensate a different temperature-induced radial extension of the rotor shaft 16 and/or the ball bearings 28,30 relative to the bearings receptacle.

[0028] Figure 4 shows an alternative shaft bearing system 22', wherein the radial inside of the bearing receptacle 24' is provided with four axially-spaced positioning ring grooves 38 which each receive a support ring 34. The positioning grooves 38 are positioned within the bearing receptacle 24' so that two positioning grooves 38 are located within the radial extent A1 of the first ball bearing 28' and two positioning grooves 38 are located within the radial extent A2 of the second ball bearing 30'. The positioning grooves 38 reliably axially support and position the support rings 34 within the bearing system 22'.

[0029] Figure 4 shows another alternative shaft bearing system 22'' with an inverse kinematic concept. The ball bearings 28'',30'' are both fixed at the radial inside of the bearing receptacle 24'' and are both provided axially shiftable with respect to the rotor shaft 16''. The axial support flange 32'' is provided at the radial outside of the rotor shaft 16'' and extends radially outwardly. The inner rings 28a'',30a'' of both ball bearings 28'',30'' are each provided with two axially-spaced positioning ring grooves 28d''30d'' which each receive an elastic support ring 34. Both ball bearings 28'',30'' are each radially supported at the rotor shaft 16'' only by the support rings 34. The inner race 30a'' of the second ball bearing 30'' is axially preloaded away from the support flange 32'' by a preload spring 36'' so that the inner race 28a'' of the first ball bearing 28'' is axially pushed against the support flange 32''.

Reference list

[0030]

10;10';10"	fluid pump	
12	pump wheel	
14	first proximal axial rotor shaft end	
16; 16"	rotor shaft	
18	driving means	5
20	second distal axial rotor shaft end	
22;22';22"	shaft bearing system	
24;24';24"	bearing receptacle	
26	pump housing	
28;28';28"	first ball bearing	10
28a,28a"	inner race	
28b	bearing balls	
28c;28c',28c"	outer race	
28d,28d"	positioning grooves	
30;30';30"	second ball bearing	15
30a,30a"	inner race	
30b	bearing balls	
30c,30c',30c"	outer race	
30d,30d"	positioning grooves	
32;32"	axial support flange	20
34	support rings	
36;36"	preload spring	
38	positioning grooves	
A1,A2	axial extents	

Claims

1. Fluid pump (10;10') for a motor vehicle, with

a driving means (18),
a pump wheel (12) being co-rotatably connected with the driving means (18) by a rotor shaft (16) and
a shaft bearing system (22;22') for the rotor shaft (16), comprising

a bearing receptacle (24;24') with a radially inwardly directed axial support flange (32) and
two floating ball bearings (28,30;28',30') both fixed to the radial outside of the rotor shaft (16) and provided axially shiftable within the bearing receptacle (24;24'),

wherein a first ball bearing (28;28') is positioned at a first axial side of the support flange (32) and a second ball bearing (30;30') is positioned at a second opposite side of the support flange (32), wherein an outer race (28c;28c') of the first ball bearing (28;28') is in touching axial contact with the support flange (32) and an outer race (30c;30c') of the second ball bearing (30;30') is axially preloaded away from the support flange (32) by a preload spring (36),

characterised in that

the bearing receptacle is static, and
each ball bearing (28,30;28',30') is provided with

at least one elastic support ring (34) radially surrounding the outer race (28c,30c;28c',30c') of the ball bearing (28,30;28',30'), and
wherein both ball bearings (28,30;28',30') are radially supported within the bearing receptacle (24;24') only by the support rings (34).

2. Fluid pump (10) according to claim 1, wherein the outer races (28c,30c) of both ball bearings (28,30) each are provided with at least one positioning groove (28d,30d) which receives the support ring (34).

3. Fluid pump (10') according to any preceding claim, wherein the bearing receptacle (24') is provided with at least two positioning grooves (38),

wherein at least one positioning groove (38) is located within the axial extent (A1,A2) of each ball bearing (28',30'), and
wherein the positioning grooves (38) receive the support rings (34).

4. Fluid pump (10;10';10") according to any preceding claim, wherein each ball bearing (28,30;28',30';28",30") is provided with exactly two axially spaced support rings (34).

5. Fluid pump (10;10';10") according to any preceding claim, wherein the shaft bearing system (22;22';22") is arranged axially between the driving means (18) and the pump wheel (12).

6. Fluid pump (10;10';10") according to any preceding claim, wherein the driving means (18) is a motor rotor of an electric motor.

7. Fluid pump (10;10';10") according to any preceding claim, wherein the fluid pump (10;10';10") is a gas pump and, in particular, a purge pump for pumping fuel vapor out of a motor vehicle fuel system.

8. Fluid pump (10") according to any preceding claim, but with an inverse kinematic concept so that the ball bearings (28",30") are both fixed to the radial inside of the bearing receptacle (24") and are provided axially shiftable with respect to the rotor shaft (16") and so that the axial support flange (32") is provided at the radial outside of the rotor shaft (16").

Patentansprüche

1. Fluidpumpe (10;10') für ein Kraftfahrzeug, mit

einem Antriebsmittel (18),
einem Pumpenrad (12), das über eine Rotorwelle (16) drehfest mit dem Antriebsmittel (18) ver-

bunden ist, und
einem Wellenlagersystem (22;22') für die Rotor-
welle (16), umfassend

eine feststehende Lageraufnahme (24;24')
mit einem radial nach innen gerichteten axi-
alen Stützflansch (32) und
zwei schwimmende Kugellager
(28,30;28',30'), die beide an der radialen
Außenseite der Rotorwelle (16) fixiert sind
und innerhalb der Lageraufnahme (24;24')
axial verschiebbar ausgeführt sind,

wobei ein erstes Kugellager (28;28') an einer
ersten axialen Seite des Stützflansches (32) po-
sitioniert ist und ein zweites Kugellager (30;30')
an einer zweiten gegenüberliegenden Seite des
Stützflansches (32) positioniert ist,
wobei ein Außenring (28c;28c') des ersten Ku-
gellagers (28;28') in berührendem axialen Kon-
takt mit dem Stützflansch (32) steht und ein Au-
ßenring (30c;30c') des zweiten Kugellagers
(30;30') durch eine Vorspannfeder (36) axial von
dem Stützflansch (32) wegweisend vorge-
spannt ist,

dadurch gekennzeichnet, dass

die Lageraufnahme feststehend ist, und
jedes Kugellager (28,30;28',30') mindestens ei-
nen elastischen Stützring (34) aufweist, der den
Außenring (28c,30c;28c',30c') des Kugellagers
(28,30;28',30') radial umgibt, und
wobei beide Kugellager (28,30;28',30') in der
Lageraufnahme (24;24') nur über die Stützringe
(34) radial gelagert sind.

2. Fluidpumpe (10) nach Anspruch 1, wobei die Außen-
ringe (28c,30c) der beiden Kugellager (28,30) je-
weils mindestens eine Positionierungsnut (28d,30d)
aufweisen, die den Stützring (34) aufnimmt.

3. Fluidpumpe (10') nach einem der vorhergehenden
Ansprüche, wobei die Lageraufnahme (24') mindes-
tens zwei Positionierungsnuten (38) aufweist,

wobei sich mindestens eine Positionierungsnut
(38) innerhalb der axialen Erstreckung (A1,A2)
eines jeden Kugellagers (28',30') befindet, und
wobei die Positionierungsnuten (38) die Stütz-
ringe (34) aufnehmen.

4. Fluidpumpe (10;10';10") nach einem der vorherge-
henden Ansprüche, wobei jedes Kugellager
(28,30;28',30';28",30") genau zwei axial beabstan-
dete Stützringe (34) aufweist.

5. Fluidpumpe (10;10';10") nach einem der vorherge-
henden Ansprüche, wobei das Wellenlagersystem
(22;22';22") axial zwischen dem Antriebsmittel (18)

und dem Pumpenrad (12) angeordnet ist.

6. Fluidpumpe (10;10';10") nach einem der vorherge-
henden Ansprüche, wobei das Antriebsmittel (18)
ein Motorrotor eines Elektromotors ist.

7. Fluidpumpe (10;10';10") nach einem der vorherge-
henden Ansprüche, wobei die Fluidpumpe
(10;10';10") eine Gaspumpe und insbesondere eine
Entlüftungspumpe zum Abpumpen von Kraftstoff-
dampf aus einem Kraftfahrzeugkraftstoffsystem ist.

8. Fluidpumpe (10") nach einem der vorhergehenden
Ansprüche, jedoch mit einem inversen kinemati-
schen Konzept, sodass die Kugellager (28", 30") bei-
de an der radialen Innenseite der Lageraufnahme
(24") fixiert sind und in Bezug auf die Rotorwelle (16")
axial verschiebbar ausgeführt sind und sodass der
axiale Stützflansch (32") an der radialen Außenseite
der Rotorwelle (16") angeordnet ist.

Revendications

1. Pompe à fluide (10;10') pour un véhicule à moteur,
avec

un moyen d'entraînement (18),
une roue de pompe (12) étant connectée de ma-
nière co-rotative au moyen d'entraînement (18)
par un arbre de rotor (16) et
un système de palier d'arbre (22 ; 22') pour l'ar-
bre de rotor (16), qui comprend
un réceptacle de palier statique (24 ; 24') avec
une flasque de support axial (32) orientée radia-
lement vers l'intérieur et
deux paliers à billes flottants (28, 30 ; 28', 30')
tous deux fixés à l'extérieur radial de l'arbre de
rotor (16) et fournis axialement déplaçables
dans le réceptacle de palier (24 ; 24'),
dans lequel un premier palier à billes (28 ; 28')
est positionné sur un premier côté axial de la
flasque de support (32) et un second palier à
billes (30 ; 30') est positionné sur un second côté
opposé de la flasque de support (32),
dans lequel une bague extérieure (28c ; 28c')
du premier palier à billes (28 ; 28') est en contact
axial touchant avec la flasque de support (32)
et une bague extérieure (30c ; 30c') du second
palier à billes (30 ; 30') est préchargée axiale-
ment à l'écart de la flasque de support (32) par
un ressort de précharge (36),

caractérisé en ce que

le palier et le réceptacle sont statiques, et
chaque palier à billes (28, 30 ; 28', 30') com-
prend au moins une bague de support élastique
(34) entourant radialement la bague extérieure
(28c, 30c ; 28c', 30c') du palier à billes (28, 30 ;

- 28', 30'), et
 dans lequel les deux paliers à billes (28, 30 ; 28', 30') sont supportés radialement à l'intérieur du réceptacle de palier (24 ; 24') uniquement par les anneaux de support (34). 5
2. Pompe à fluide (10) selon la revendication 1, dans laquelle les bagues extérieures (28c, 30c) des deux paliers à billes (28, 30) sont chacune munies d'au moins une rainure de positionnement (28d, 30d) qui reçoit la bague de support (34). 10
3. Pompe à fluide (10') selon l'une des revendications précédentes, dans laquelle le réceptacle de palier (24') comprend au moins deux rainures de positionnement (38), 15
- dans laquelle au moins une rainure de positionnement (38) est située dans l'étendue axiale (A1, A2) de chaque palier à billes (28', 30'), et 20
- dans lequel les rainures de positionnement (38) reçoivent les bagues de support (34).
4. Pompe à fluide (10 ; 10' ; 10'') selon l'une quelconque des revendications précédentes, dans laquelle chaque palier à billes (28, 30 ; 28', 30' ; 28'', 30'') est pourvu d'exactly deux bagues de support (34) espacées axialement. 25
5. Pompe à fluide (10 ; 10' ; 10'') selon l'une des revendications précédentes, dans laquelle le système de palier d'arbre (22 ; 22' ; 22'') est arrangé axialement entre le moyen d'entraînement (18) et la roue de pompe (12). 30
- 35
6. Pompe à fluide (10 ; 10' ; 10'') selon l'une de revendications précédentes, dans laquelle le moyen d'entraînement (18) est un rotor de moteur d'un moteur électrique. 40
- 45
7. Pompe à fluide (10;10';10'') selon l'une des revendications précédentes, dans laquelle la pompe à fluide (10;10';10'') est une pompe à gaz et, en particulier, une pompe de purge pour pomper la vapeur de carburant hors d'un système de carburant de véhicule à moteur. 50
- 55
8. Pompe à fluide (10'') selon l'une des revendications précédentes, mais avec un concept de cinétique inverse de sorte que les paliers à billes (28'', 30'') sont tous deux fixés à l'intérieur radial du réceptacle de palier (24'') et sont fournis axialement déplaçables par rapport à l'arbre de rotor (16'') et de sorte que la flasque de support axial (32'') est fournie à l'extérieur radial de l'arbre de rotor (16''). 55

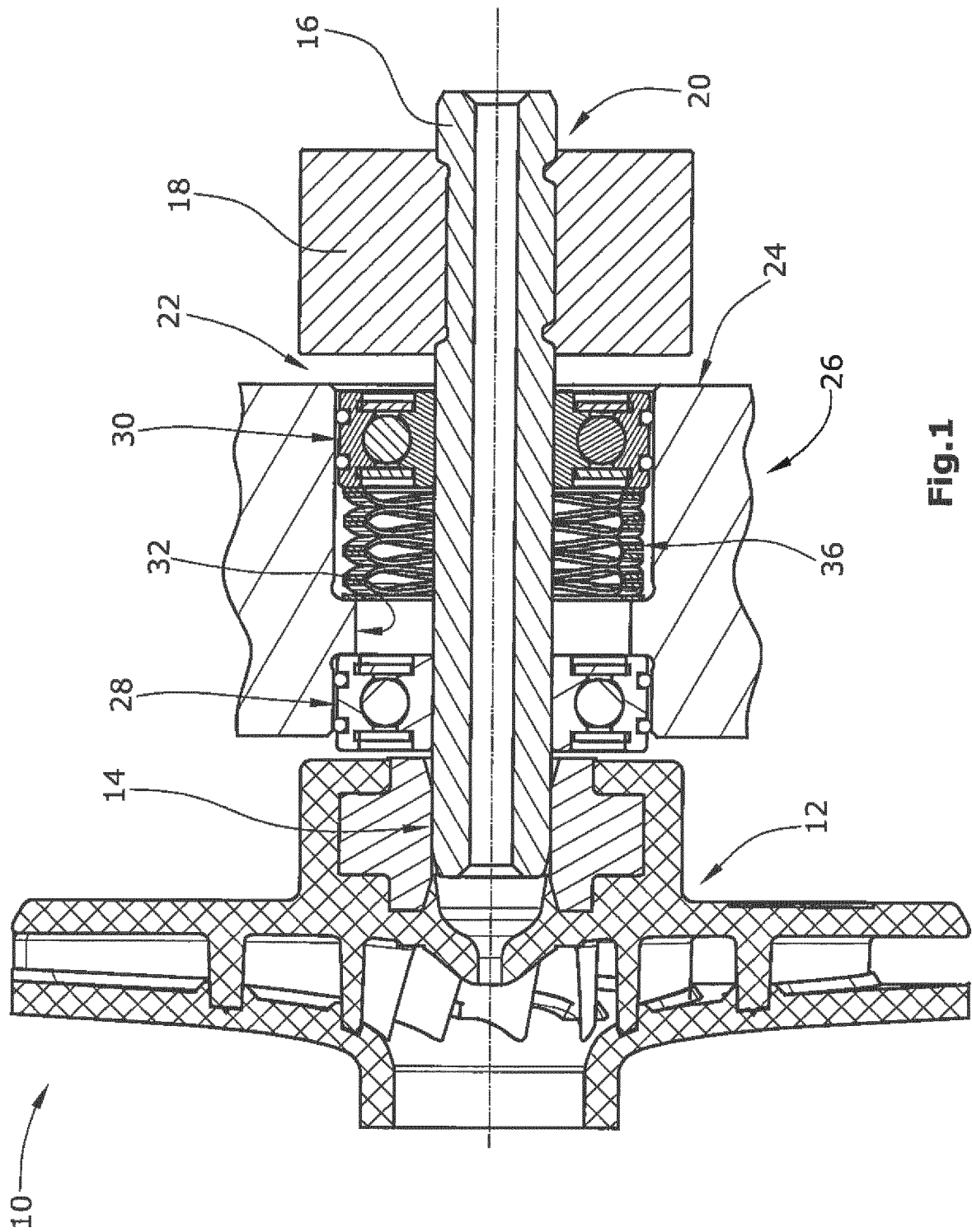


Fig.1

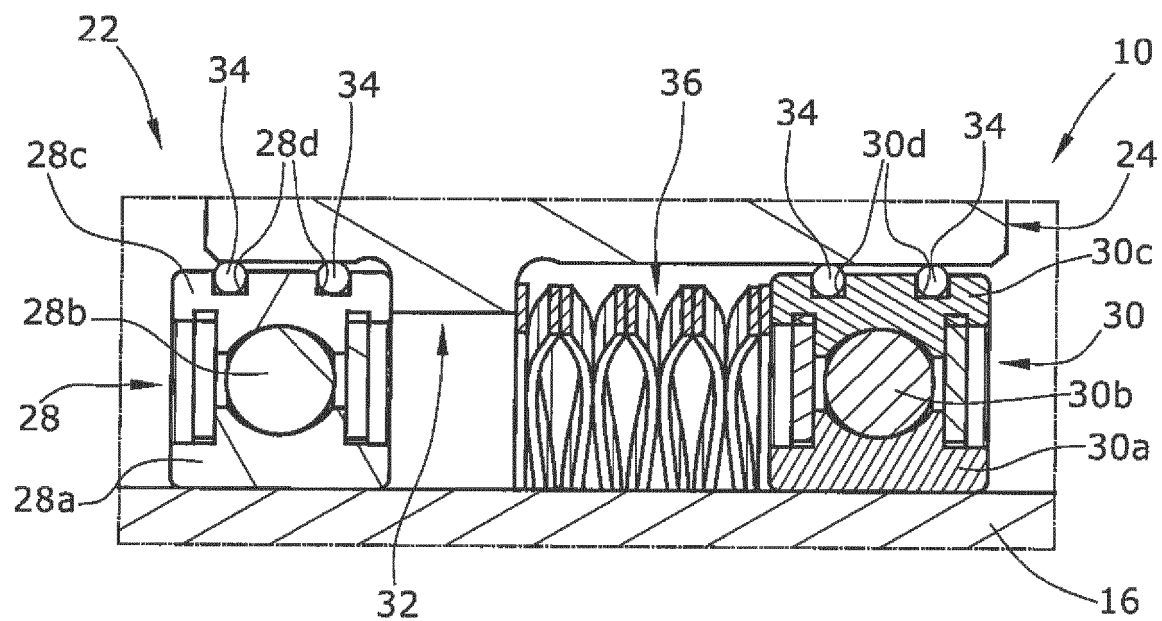


Fig.2

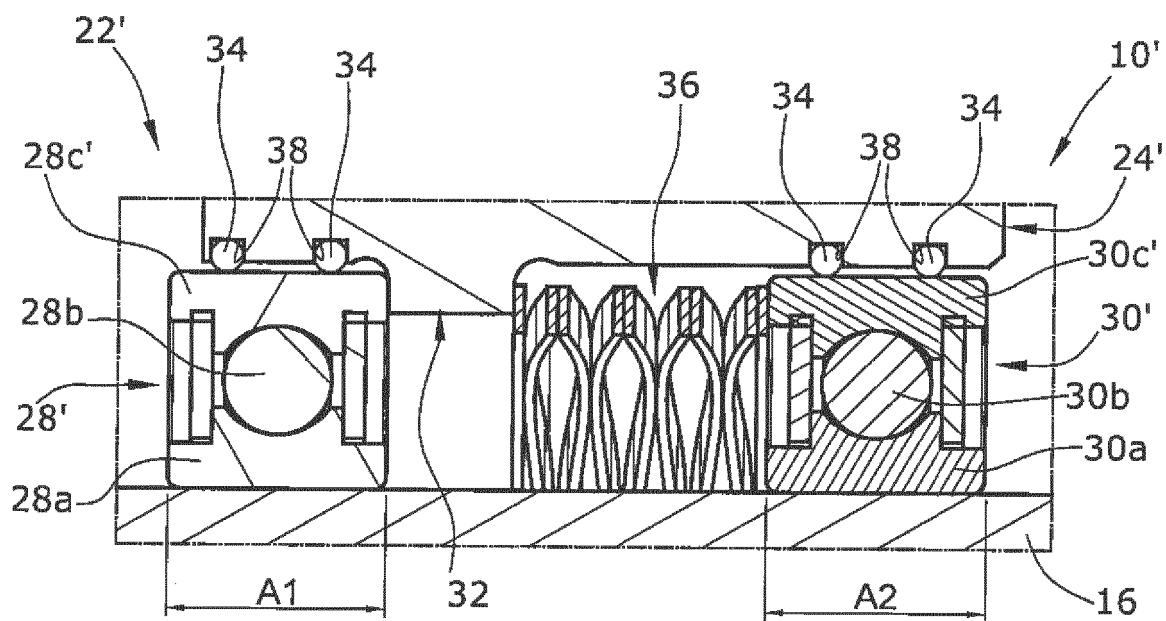


Fig.3

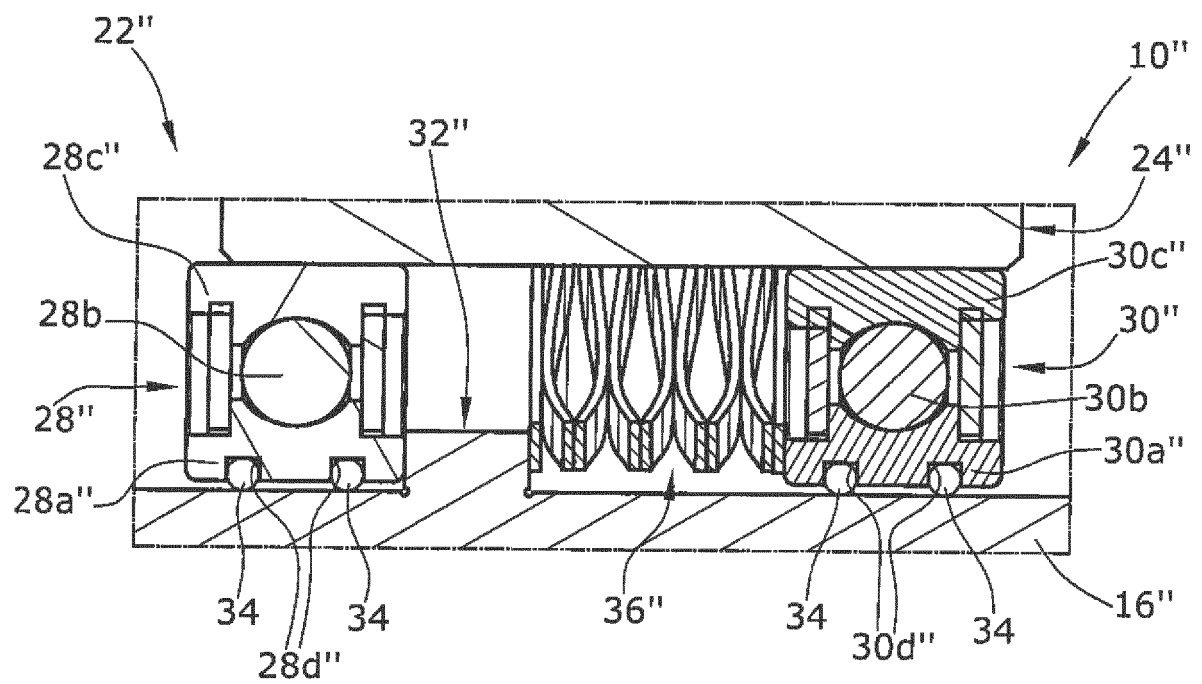


Fig.4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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